What is claimed:

1. A non-murine antibody that competes with monoclonal antibody RX1 for binding to M-CSF by more than 75%, wherein said monoclonal antibody RX1 comprising the heavy chain and light chain amino acid sequences set forth in SEQ ID NOs: 2 and 4, respectively.

2. The antibody of claim 1 that specifically binds to the same epitope of M-CSF as monoclonal antibody RX1, wherein said monoclonal antibody RX1 comprises the heavy chain and light chain amino acid sequences set forth in SEQ ID NOs: 2 and 4, respectively.

3. The antibody of claim 2 that binds an epitope of M-CSF that comprises at least 4 contiguous residues of SEQ ID NO: 120 or 121.

4. The antibody of claim 2 that binds an epitope of M-CSF that comprises SEQ ID NO: 120 or 121.

5. The antibody of any of claims 1-4 that is a monoclonal antibody.

6. The antibody of any of claims 1-4 that is a chimeric antibody, a humanized antibody, a human engineered antibody, a human antibody, or a single chain antibody.

7. The antibody of any of claims 1-6 that is an IgG antibody.

8. The antibody of any of claims 1-4 that is an Fab fragment, an F(ab')2 fragment, an Fv fragment, or a single chain Fv fragment.

9. The antibody of any of claims 1-8 that retains an affinity K_d (dissociation equilibrium constant) with respect to M-CSF of SEQ ID NO: 9 of at least 10^{-7} M or higher.

10. The antibody of claim 9 that retains an affinity Kd with respect to M-CSF of SEQ ID NO: 9 of at least 10^{-8} M or higher.

11. The antibody of claim 10 that retains an affinity Kd with respect to M-CSF of SEQ ID NO: 9 of at least 10^{-9} M or higher.

12. The antibody of any of claims 1-11 that comprises an amino acid sequence 90% identical to SEQ ID NO: 24.

13. The antibody of claim 11 that comprises SEQ ID NO: 24.

14. The antibody of any of claims 1-13 that comprises at least 1 of SEQ ID NOs: 18, 21, 24, 29, 32, and 36.

15. The antibody of any of claims 1-13 that comprises at least 2 of SEQ ID NOs: 18, 21, 24, 29, 32, and 36.

16. The antibody of any of claims 1-13 that comprises at least 3 of SEQ ID NOs: 18, 21, 24, 29, 32, and 36.

17. The antibody of any of claims 1-13 that comprises at least 4 of SEQ ID NOs: 18, 21, 24, 29, 32, and 36.

18. The antibody of any of claims 1-13 that comprises at least 5 of SEQ ID NOs: 18, 21, 24, 29, 32, and 36.

19. The antibody of any of claims 1-13 that comprises all of SEQ ID NOs: 18, 21, 24, 29, 32, and 36.

20. The antibody of any of claims 11-18 that further comprises one or more of SEQ ID NOs: 16, 19, 22, 27, 30, and 34.

21. The antibody of any of claims 11-18 that further comprises one or more of SEQ ID NOs: 17, 20, 23, 28, 31, and 35.

22. The antibody of any of claims 11-18 that further comprises one or more of SEQ ID NOs: 18, 21, 25, 29, 32, and 37.

23. The antibody of any of claims 11-18 that further comprises one or more consensus CDRs set forth in SEQ ID NOs: 18, 21, 26, 29, 33, and 38.

24. The antibody of any of claims 11-23 in which at least one amino acid within a CDR is substituted by a corresponding residue of a corresponding CDR of another anti-MCSF antibody.

25. The antibody of any of claims 11-24 comprising a variable light chain amino acid sequence which is at least 65% homologous to the amino acid sequence set forth in SEQ ID NO: 4.

26. The antibody of any of claims 11-25 comprising a variable heavy chain amino acid sequence which is at least 65% homologous to the amino acid sequence set forth in SEQ ID NO: 2.

27. The antibody of any of claims 1-26 comprising a constant region of a

human antibody sequence and one or more heavy and light chain variable framework regions of a human antibody sequence.

28. The antibody of claim 27 wherein the human antibody sequence is an individual human sequence, a human consensus sequence, an individual human germline sequence, or a human consensus germline sequence.

29. The antibody of claim 27 that comprises a fragment of an IgG1 constant region.

30. The antibody of claim 29 that comprises a mutation in the IgG1 constant region that reduces antibody-dependent cellular cytotoxicity or complement dependent cytotoxicity activity.

31. The antibody of claim 27 that comprises a fragment of an IgG4 constant region.

32. The antibody of claim 31 that comprises a mutation in the IgG4 constant region that reduces formation of half-antibodies.

33. The antibody of any of claims 1-32, comprising a heavy chain variable region that comprises the amino acid sequence XVXLXEXGXXXXXXXXXLXLXCXVXDYSITSDYAWNWIXQXXXXXLXWMGYISY SGSTSXNXXLXXXIXIXRXXXXXXFXLXLXXVXXXDXAXYYCASFDYAHAMDYW GXGTXVXVXX, wherein X is any amino acid.

34. The antibody of any of claims 1-32, comprising a heavy chain variable region that comprises the amino acid sequence DVXLXEXGPXXVXPXXXLXLXCXVTDYSITSDYAWNWIRQXPXXKLEWMGYISYS GSTSYNPSLKXRIXIXRXTXXNXFXLXLXXVXXXDXATYYCASFDYAHAMDYWGX GTXVXVXX, wherein X is any amino acid.

35. The antibody of any of claims 1-32, comprising a heavy chain variable region that comprises the amino acid sequence XVQLQESGPGLVKPSQXLSLTCTVXDYSITSDYAWNWIRQFPGXXLEWMGYISYSGS TSYNPSLKSRIXIXRDTSKNQFXLQLNSVTXXDTAXYYCASFDYAHAMDYWGQGTX VTVSS, wherein X is any amino acid.

36. The antibody of any of claims 1-32, comprising a heavy chain variable region that comprises the amino acid sequence DVQLQESGPGLVKPSQXLSLTCTVTDYSITSDYAWNWIRQFPGXKLEWMGYISYSGS TSYNPSLKSRIXIXRDTSKNQFXLQLNSVTXXDTATYYCASFDYAHAMDYWGQGTX VTVSS, wherein X is any amino acid.

37. The antibody of any of claims 1-32, comprising a heavy chain variable region that comprises the amino acid sequence DVQLQESGPGLVKPSQTLSLTCTVTDYSITSDYAWNWIRQFPGKKLEWMGYISYSGS

TSYNPSLKSRITISRDTSKNQFSLQLNSVTAADTATYYCASFDYAHAMDYWGQGTTV
TV
SS.

38. The antibody of any of claims 1-32, comprising a heavy chain variable region that comprises the amino acid sequence
QVQLQESGPGLVKPSQTLSLTCTVSDYSITSDYAWNWIRQFPGKGLEWMGYISYSGS
TSYNPSLKSRITISRDTSKNQFSLQLNSVTAADTAVYYCASFDYAHAMDYWGQGTT
VTV
SS.

39. The antibody of any of claims 1-32, comprising a light chain variable region that comprises the amino acid sequence
XIXLXQXXXXXXVXXXXXVXFXCXAXQSIGTSIHWYXQXXXXXPXLLIKYASEXX
XXIXXXFXGXGXGXXFXLXIXXVXXXDXADYYCQQINSWPTTFGXGTXLXXXXX,
wherein X is any amino acid.

40. The antibody of any of claims 1-32, comprising a light chain variable region that comprises the amino acid sequence
XIXLXQXPXXLXVXPXXXVXFXCXASQSIGTSIHWYQQXTXXSPRLLIKYASEXISXI
PXRFXGXGXGXXFXLXIXXVXXXDXADYYCQQINSWPTTFGXGTXLXXXXX,
wherein X is any amino acid.

41. The antibody of any of claims 1-32, comprising a light chain variable region that comprises the amino acid sequence
XIXLTQSPXXLSVSPGERVXFSCRASQSIGTSIHWYQQXTXXXPRLLIKYASEXXXGIP
XRFSGSGSGTDFTLXIXXVESEDXADYYCQQINSWPTTFGXGTKLEIKRX, wherein X
is any amino acid.

42. The antibody of any of claims 1-32, comprising a light chain variable region that comprises the amino acid sequence
XIXLTQSPXXLSVSPGERVXFSCRASQSIGTSIHWYQQXTXXSPRLLIKYASEXISGIPX
RFSGSGSGTDFTLXIXXVESEDXADYYCQQINSWPTTFGXGTKLEIKRX, wherein X is
any amino acid.

43. The antibody of any of claims 1-32, comprising a light chain variable region that comprises the amino acid sequence
XIXLTQSPXXLSVSPGERVXFSCRASQSIGTSIHWYQQXTXXXPRLLIKYASESISGIPX
RFSGSGSGTDFTLXIXXVESEDXADYYCQQINSWPTTFGXGTKLEIKRX, wherein X is
any amino acid.

44. The antibody of any of claims 1-32, comprising a light chain variable region that comprises the amino acid sequence
EIVLTQSPGTLSVSPGERVTFSCRASQSIGTSIHWYQQKTGQAPRLLIKYASESISGIPD
RFSGSGSGTDFTLTISRVESEDFADYYCQQINSWPTTFGQGTKLEIKRT.

45. The antibody of any of claims 1-32, comprising a light chain variable region that comprises the amino acid sequence
EIVLTQSPGTLSVSPGERVTFSCRASQSIGTSIHWYQQKTGQAPRLLIKYASERATGIP
DRFSGSGSGTDFTLTISRVESEDFADYYCQQINSWPTTFGQGTKLEIKRT.

46. The antibody of any of claims 1-32, comprising a light chain variable region that comprises the amino acid sequence EIVLTQSPGTLSVSPGERVTFSCRASQSIGTSIHWYQQKTGQSPRLLIKYASERISGIPD RFSGSGSGTDFTLTISRVESEDFADYYCQQINSWPTTFGQGTKLEIKRT.

47. The antibody of any of claims 33-46 wherein at least one X is the same as an amino acid at the same corresponding position in SEQ ID NOs: 2 or 4 using Kabat numbering.

48. The antibody of any of claims 33-46, wherein at least one X is a conservative substitution of an amino acid at the same corresponding position in SEQ ID NOs: 2 or 4 using Kabat numbering.

49. The antibody of any of claims 33-46, wherein at least one X is a non-conservative substitution of an amino acid at the same corresponding position in SEQ ID NOs: 2 or 4 using Kabat numbering.

50. The antibody of any of claims 33-46, wherein at least one X is an amino acid at the same corresponding position within a human antibody sequence, using Kabat numbering.

51. The antibody of any of claims 33-46, wherein at least one X is an amino acid at the same corresponding position within a human consensus antibody sequence, using Kabat numbering.

52. The antibody of claim 50 wherein the human antibody sequence is a human consensus sequence, human germline sequence, human consensus germline sequence, or any one of the human antibody sequences in Kabat.

53. The antibody of any of claims 1-32 comprising any one of the heavy chain sequences set forth in SEQ ID NOS: 114, 116, or 119.

54. The antibody of any of claims 1-32 comprising any one of the heavy chain variable region sequences set forth in SEQ ID NOS: 41 or 43.

55. The antibody of any of claims 1-32 comprising any one of the light chain sequences set forth in SEQ ID NOS: 45, 47, 48, 51, 53 or 136.

56. The antibody of claim 1 comprising the heavy chain sequence set forth in SEQ ID NO: 114 and the light chain sequence set forth in SEQ ID NO: 47.

57. The antibody of claim 1 comprising the heavy chain sequence set forth in SEQ ID NO: 116 and the light chain sequence set forth in SEQ ID NO: 47.

58. The antibody of claim 1 comprising the heavy chain sequence set forth in SEQ ID NO: 119 and the light chain sequence set forth in SEQ ID NO: 47.

59. The antibody of any of claims 33-46 comprising a variable heavy chain

amino acid sequence which is at least 65% identical to the variable heavy chain amino acid sequence set forth in SEQ ID NOs: 41 or 43.

60. The antibody of claim 59 comprising a variable heavy chain amino acid sequence which is at least 80% identical to the variable heavy chain amino acid sequence set forth in SEQ ID NOs: 41 or 43.

61. The antibody of any of claims 33-46 comprising a variable light chain amino acid sequence which is at least 65% identical to the variable light chain amino acid sequence set forth in SEQ ID NOs: 45, 47, 48, 51, or 53.

62. The antibody of claim 61 comprising a variable light chain amino acid sequence which is at least 80% identical to the variable light chain amino acid sequence set forth in SEQ ID NOs: 45, 47, 48, 51, or 53.

63. An antibody comprising a heavy chain as set forth in any one of claims 33-38, 53 or 59-60 and a light chain as set forth in any one of claims 39-46, 54 or 61-62.

64. The antibody of any of claims 12-63 that has an affinity Kd of at least 10^{-7}.

65. The antibody of claim 64 that has an affinity Kd of at least 10^{-9}.

66. An isolated nucleic acid comprising a nucleic acid sequence encoding a light chain of the antibody of any one of claims 1-65.

67. The isolated nucleic acid of claim 66 comprising a heavy chain nucleic acid sequence is at least 65% identical to the heavy chain nucleotide sequence set forth in SEQ ID NO: 1 or SEQ ID NOs: 40 or 42.

68. The isolated nucleic acid of claim 67 comprising a heavy chain nucleic acid sequence is at least 80% identical to the heavy chain nucleotide sequence set forth in SEQ ID NO: 1or SEQ ID NOs: 40 or 42.

69. The isolated nucleic acid of claim 66 comprising a light chain nucleic acid sequence is at least 65% identical to the light chain nucleotide sequence set forth in SEQ ID NO: 3 or SEQ ID NOs: 44, 46, 52, 135, or 137.

70. The isolated nucleic acid of claim 69 comprising a light chain nucleic acid sequence is at least 80% identical to the light chain nucleotide sequence set forth in SEQ ID NO: 3 or SEQ ID NOs: 44, 46, 52, 135, or 137.

71. A vector comprising the isolated nucleic acid of any one of claims 66-70.

72. The vector of claim 71, wherein the isolated nucleic acid is operably linked to a regulatory control sequence.

73. A host cell comprising the vector of claim 72 or the nucleic acid of any one of claims 66-70.

74. A method of producing an antibody of any one of claims 1-65 comprising culturing a host cell of claim 73 such that the isolated nucleic acid is expressed to produce the antibody.

75. The method of claim 74, further comprising the step of recovering the antibody from the host cell culture.

76. An isolated antibody produced by the method of claim 75.

77. A hybridoma or host cell that secretes an antibody according to any one of claims 1-5.

78. An antibody of any of claims 1-65 or 76 that is conjugated to a toxin.

79. A pharmaceutical composition comprising any one of the antibodies of claims 1-65 or 76, and a pharmaceutically suitable carrier, excipient or diluent.

80. The pharmaceutical composition of claim 79 further comprising a second therapeutic agent.

81. The pharmaceutical composition of claim 80 wherein the second therapeutic agent is a cancer chemotherapeutic agent.

82. The pharmaceutical composition of claim 80 wherein the second therapeutic agent is a bisphosphonate.

83. The pharmaceutical composition of claim 82 wherein the bisphonate is zeledronate, pamidronate, clodronate, etidronate, tilundronate, alendronate, or ibandronate.

84. The pharmaceutical composition of claim 80 wherein the second therapeutic agent is another antibody.

85. The antibody of any of claims 1-41 or 50 that binds to M-CSF for preventing a subject afflicted with a disease that causes or contributes to osteolysis, wherein said antibody effectively reduces the severity of bone loss associated with the disease.

86. The antibody of any of claims 1-65 or 76 that binds to M-CSF for treating a subject afflicted with a disease that causes or contributes to osteolysis, wherein said antibody effectively reduces the severity of bone loss associated with the disease.

87. The antibody according to claim 86 wherein said disease is selected from the group consisting of metabolic bone diseases associated with relatively increased

osteoclast activity, including endocrinopathies (including hypercortisolism, hypogonadism, primary or secondary hyperparathyroidism, hyperthyroidism), hypercalcemia, deficiency states (including rickets/osteomalacia, scurvy, malnutrition), chronic diseases (including malabsorption syndromes, chronic renal failure (including renal osteodystrophy), chronic liver disease (including hepatic osteodystrophy)), drugs (including glucocorticoids (glucocorticoid-induced osteoporosis), heparin, alcohol), and hereditary diseases (including osteogenesis imperfecta, homocystinuria), cancer, osteoporosis, osteopetrosis, inflammation of bone associated with arthritis and rheumatoid arthritis, periodontal disease, fibrous dysplasia, and/or Paget's disease.

88. The antibody according to any one of claims 1-65 or 76 that binds to M-CSF for preventing or treating metastatic cancer to bone, wherein the metastatic cancer is breast, lung, renal, multiple myeloma, thyroid, prostate, adenocarcinoma, blood cell malignancies, including leukemia or lymphoma; head or neck cancers; gastrointestinal cancers, including esophageal cancer, stomach cancer, colon cancer, intestinal cancer, colorectal cancer, rectal cancer, pancreatic cancer, liver cancer, cancer of the bile duct or gall bladder; malignancies of the female genital tract, including ovarian carcinoma, uterine endometrial cancers, vaginal cancer, or cervical cancer; bladder cancer; brain cancer, including neuroblastoma; sarcoma, osteosarcoma; or skin cancer, including malignant melanoma or squamous cell cancer.

89. A method of preventing or reducing bone loss comprising administering to a subject afflicted with a disease that causes or contributes to osteolysis a therapeutically effective amount of the antibody of any one of claims 1 through 65 or 76, in an amount effective to prevent or reduce bone loss associated with the disease.

90. A method of treating a subject afflicted with a disease that causes or contributes to osteolysis comprising administering to said subject a therapeutically effective amount of the antibody of any one of claims 1 through 65 or 76, in an amount effective to reduce the severity of bone loss associated with the disease.

91. The method of claim 89 or 90 wherein said disease is selected from the group consisting of metabolic bone diseases associated with relatively increased osteoclast activity, including endocrinopathies (including hypercortisolism, hypogonadism, primary or secondary hyperparathyroidism, hyperthyroidism), hypercalcemia, deficiency states (including rickets/osteomalacia, scurvy, malnutrition), chronic diseases (including

malabsorption syndromes, chronic renal failure (including renal osteodystrophy), chronic liver disease (including hepatic osteodystrophy)), drugs (including glucocorticoids (glucocorticoid-induced osteoporosis), heparin, alcohol), and hereditary diseases (including osteogenesis imperfecta, homocystinuria), cancer, osteoporosis, osteopetrosis, inflammation of bone associated with arthritis and rheumatoid arthritis, periodontal disease, fibrous dysplasia, and/or Paget's disease.

92. A method of preventing or treating metastatic cancer to bone, comprising administering to a subject afflicted with metastatic cancer a therapeutically effective amount of the antibody of any one of claims 1-65 or 76.

93. The method of claim 92 wherein the metastatic cancer is breast, lung, renal, multiple myeloma, thyroid, prostate, adenocarcinoma, blood cell malignancies, including leukemia or lymphoma; head or neck cancers; gastrointestinal cancers, including esophageal cancer, stomach cancer, colon cancer, intestinal cancer, colorectal cancer, rectal cancer, pancreatic cancer, liver cancer, cancer of the bile duct or gall bladder; malignancies of the female genital tract, including ovarian carcinoma, uterine endometrial cancers, vaginal cancer, or cervical cancer; bladder cancer; brain cancer, including neuroblastoma; sarcoma, osteosarcoma; or skin cancer, including malignant melanoma or squamous cell cancer.

94. A method of treating cancer comprising administering to a subject in need thereof therapeutically effective amounts of an antibody of any of claims 1-65 or 76.

95. The method of any of claims 89-94 further comprising administering a second therapeutic agent.

96. The method of claim 95 wherein the second therapeutic agent is a cancer chemotherapeutic agent.

97. The method of claim 95 wherein the second therapeutic agent is a non-M-CSF colony stimulating factor, or anti-RANKL antibody, or soluble RANKL receptor.

98. The method of claims 95 wherein the second therapeutic agent is a bisphosphonate.

99. The method of claim 98 wherein the bisphonate is zeledronate, pamidronate, clodronate, etidronate, tilundronate, alendronate, or ibandronate.

100. The method of 98 or 99 wherein the subject is precluded from receiving bisphosphonate treatment.

101. The method of any of claims 95-100 wherein the antibody is effective to reduce the dosage of second therapeutic agent required to achieve a therapeutic effect.

102. The method of any of claims 89-101 wherein said subject is a mammal.

103. The method of any of claims 89-101 wherein said antibody is administered in an amount effective to inhibit osteoclast proliferation and/or differentiation induced by tumor cells.

104. The method of any of claims 89-103 wherein the antibody is administered at a dose between about 2 μg/kg to 30 mg/kg body weight.

105. The method of claim 104 wherein the antibody is administered at a dose between about 0.1 mg/kg to 30 mg/kg body weight.

106. The method of claim 105 wherein the antibody is administered at a dose between about 0.1 mg/kg to 10 mg/kg body weight.

107. Use of the antibody of any one of claims 1 through 65 or 76 in the manufacture of a medicament for preventing or reducing bone loss in a patient exhibiting osteolysis.

108. Use of the antibody of any one of claims 1 through 65 or 76 in the manufacture of a medicament for treating a patient afflicted with a disease that causes or contributes to osteolysis.

109. The use of claim 108 wherein said disease is selected from the group consisting of metabolic bone diseases associated with relatively increased osteoclast activity, including endocrinopathies (including hypercortisolism, hypogonadism, primary or secondary hyperparathyroidism, hyperthyroidism), hypercalcemia, deficiency states (including rickets/osteomalacia, scurvy, malnutrition), chronic diseases (including malabsorption syndromes, chronic renal failure (including renal osteodystrophy), chronic liver disease (including hepatic osteodystrophy)), drugs (including glucocorticoids (glucocorticoid-induced osteoporosis), heparin, alcohol), and hereditary diseases (including osteogenesis imperfecta, homocystinuria), cancer, osteoporosis, osteopetrosis, inflammation of bone associated with arthritis and rheumatoid arthritis, periodontal disease, fibrous dysplasia, and/or Paget's disease.

110. Use of the antibody of any one of claims 1 through 65 or 76 in the

manufacture of a medicament for preventing or treating metastatic cancer to bone in a patient suffering from metastatic cancer.

111. The use of claim 110 wherein the metastatic cancer is breast, lung, renal, multiple myeloma, thyroid, prostate, adenocarcinoma, blood cell malignancies, including leukemia or lymphoma; head or neck cancers; gastrointestinal cancers, including esophageal cancer, stomach cancer, colon cancer, intestinal cancer, colorectal cancer, rectal cancer, pancreatic cancer, liver cancer, cancer of the bile duct or gall bladder; malignancies of the female genital tract, including ovarian carcinoma, uterine endometrial cancers, vaginal cancer, or cervical cancer; bladder cancer; brain cancer, including neuroblastoma; sarcoma, osteosarcoma; or skin cancer, including malignant melanoma or squamous cell cancer.

112. Use of the antibody of any one of claims 1 through 65 or 76 in the manufacture of a medicament for treating a patient having cancer.

113. The use of any of claims 107-112 wherein said medicament is coordinated with treatment using a second therapeutic agent.

114. The use of claim 113 wherein the second therapeutic agent is a cancer chemotherapeutic agent.

115. The use of claim 113 wherein the second therapeutic agent is a non-M-CSF colony stimulating factor, or anti-RANKL antibody, or soluble RANKL receptor.

116. The use of claim 113 wherein the second therapeutic agent is a bisphosphonate.

117. The use of claim 116 wherein the bisphonate is zeledronate, pamidronate, clodronate, etidronate, tilundronate, alendronate, or ibandronate.

118. The use of claim 116 or 117 wherein the patient is precluded from receiving bisphosphonate treatment.

119. The use of any of claims 107-112 wherein said patient has been pre-treated with the second therapeutic agent.

120. The use of claim 119 wherein the second therapeutic agent is a cancer chemotherapeutic agent.

121. The use of claim 119 wherein the second therapeutic agent is a non-M-CSF colony stimulating factor, or anti-RANKL antibody, or soluble RANKL receptor.

122. The use of claim 119 wherein the second therapeutic agent is a bisphosphonate.

123. The use of claim 122 wherein the bisphonate is zeledronate, pamidronate, clodronate, etidronate, tilundronate, alendronate, or ibandronate.

124. The use of claim 122 or 123 wherein the patient is precluded from receiving bisphosphonate treatment.

125. The use of a synergistic combination of the antibody of any one of claims 1 through 65 or 76 for preparation of a medicament for treating a patient exhibiting osteolysis wherein said medicament is coordinated with treatment using a second therapeutic agent.

126. The use of claim 125 wherein the second therapeutic agent is a cancer chemotherapeutic agent.

127. The use of claim 125 wherein the second therapeutic agent is a non-M-CSF colony stimulating factor, or anti-RANKL antibody, or soluble RANKL receptor.

128. The use of claim 125 wherein the second therapeutic agent is a bisphosphonate.

129. The use of claim 125 wherein the bisphonate is zeledronate, pamidronate, clodronate, etidronate, tilundronate, alendronate, or ibandronate.

130. The use of claim 128 or 129 wherein the patient is precluded from receiving bisphosphonate treatment.

131. The use of any of claims 113-130 wherein the amount of antibody in the medicament is at a dose effective to reduce the dosage of second therapeutic agent required to achieve a therapeutic effect.

132. The use of any of claims 107-139 wherein the amount of antibody in the medicament is effective to inhibit osteoclast proliferation and/or differentiation induced by tumor cells.

133. The use of any of claims 89-103 wherein the amount of antibody in the medicament is at a dose between about 2 μg/kg to 30 mg/kg body weight.

134. The use of claim 104 wherein the the amount of antibody in the medicament is at a dose between about 0.1 mg/kg to 30 mg/kg body weight.

135. The use of claim 105 wherein the amount of antibody in the medicament is at a dose between about 0.1 mg/kg to 10 mg/kg body weight.

136. A kit comprising a therapeutically effective amount of the antibody of any one of claims 1 through 65 or 76, packaged in a container, such as a vial or bottle, and further comprising a label attached to or packaged with the container, the label describing the contents of the container and providing indications and/or instructions regarding use of the contents of the container to prevent or reduce bone loss.

137. A kit comprising a therapeutically effective amount of the antibody of any one of claims 1 through 65 or 76, packaged in a container, such as a vial or bottle, and further comprising a label attached to or packaged with the container, the label describing the contents of the container and providing indications and/or instructions regarding use of the contents of the container to a patient afflicted with a disease that causes or contributes to osteolysis.

138. The kit of claim 137 wherein said disease is selected from the group consisting of metabolic bone diseases associated with relatively increased osteoclast activity, including endocrinopathies (including hypercortisolism, hypogonadism, primary or secondary hyperparathyroidism, hyperthyroidism), hypercalcemia, deficiency states (including rickets/osteomalacia, scurvy, malnutrition), chronic diseases (including malabsorption syndromes, chronic renal failure (including renal osteodystrophy), chronic liver disease (including hepatic osteodystrophy)), drugs (including glucocorticoids (glucocorticoid-induced osteoporosis), heparin, alcohol), and hereditary diseases (including osteogenesis imperfecta, homocystinuria), cancer, osteoporosis, osteopetrosis, inflammation of bone associated with arthritis and rheumatoid arthritis, periodontal disease, fibrous dysplasia, and/or Paget's disease.

139. A kit comprising a therapeutically effective amount of the antibody of any one of claims 1 through 65 or 76, packaged in a container, such as a vial or bottle, and further comprising a label attached to or packaged with the container, the label describing the contents of the container and providing indications and/or instructions regarding use of the contents of the container to prevent or treat metastatic cancer to bone.

140. The kit of claim 139 wherein the metastatic cancer is breast, lung, renal, multiple myeloma, thyroid, prostate, adenocarcinoma, blood cell malignancies, including leukemia or lymphoma; head or neck cancers; gastrointestinal cancers, including

esophageal cancer, stomach cancer, colon cancer, intestinal cancer, colorectal cancer, rectal cancer, pancreatic cancer, liver cancer, cancer of the bile duct or gall bladder; malignancies of the female genital tract, including ovarian carcinoma, uterine endometrial cancers, vaginal cancer, or cervical cancer; bladder cancer; brain cancer, including neuroblastoma; sarcoma, osteosarcoma; or skin cancer, including malignant melanoma or squamous cell cancer.

141. A kit comprising a therapeutically effective amount of the antibody of any one of claims 1 through 65 or 76, packaged in a container, such as a vial or bottle, and further comprising a label attached to or packaged with the container, the label describing the contents of the container and providing indications and/or instructions regarding use of the contents of the container to treat cancer.

142. The kit of any of claims 136-141 further comprising a second therapeutic agent.

143. The kit of claim 142 wherein the second therapeutic agent is a cancer chemotherapeutic agent.

144. The kit of claim 142 wherein the second therapeutic agent is a non-M-CSF colony stimulating factor, or anti-RANKL antibody, or soluble RANKL receptor.

145. The kit of claims 142 wherein the second therapeutic agent is a bisphosphonate.

146. The kit of claim 145 wherein the bisphonate is zeledronate, pamidronate, clodronate, etidronate, tilundronate, alendronate, or ibandronate.

147. The kit of any of claims 136-146 including instructions to treat a patient precluded from receiving bisphosphonate treatment.

148. The kit of any of claims 136-147 comprising a dose of antibody effective to reduce the dosage of second therapeutic agent required to achieve a therapeutic effect.

149. The kit of any of claims 136-147 comprising a synergistic dose of antibody.

150. The kit of any of claims 136-147 comprising a dose of antibody effective to inhibit osteoclast proliferation and/or differentiation induced by tumor cells.

151. The kit of any of claims 136-147 comprising a dose of antibody

between about 2 μg/kg to 30 mg/kg body weight.

152. The kit of claim 151 comprising a dose of antibody between about 0.1 mg/kg to 30 mg/kg body weight.

153. The kit of claim 152 comprising a dose of antibody between about 0.1 mg/kg to 10 mg/kg body weight.

154. A method of screening for an M-CSF-specific antibody comprising the steps of

a) contacting metastatic tumor cell medium, osteoclasts and a candidate antibody;

b) detecting osteoclast formation, proliferation and/or differentiation; and

c) identifying said candidate antibody as an M-CSF-specific antibody if a decrease in osteoclast formation, proliferation and/or differentiation is detected.

155. The method of screening according to claim 154 wherein said metastatic tumor cell medium includes tumor cells.

156. The method of screening according to claim 154 wherein the contacting step (a) occurs in vivo, said detecting step (b) comprises detecting size and/or number of bone metastases, and the candidate antibody is identified as an M-CSF-specific antibody if a decrease in size and/or number of bone metastases is detected.

157. The method of screening according to claims 154-156 further comprising the step of determining if the candidate antibody binds to M-CSF.

158. The method of screening according to claims 154-157 further comprising the step of determining if said candidate antibody inhibits interaction between M-CSF and its receptor M-CSFR.

159. A method of identifying an M-CSF-specific antibody that can prevent or treat metastatic cancer to bone comprising the steps of:

(a) detecting binding of a candidate antibody to an epitope of M-CSF that includes at least 4 contiguous residues of SEQ ID NOs: 120 or 121; and

(b) assaying the ability of said candidate antibody to prevent or treat metastatic cancer to bone *in vitro* or *in vivo*.

160. A method of systematically altering up to 60% of the heavy chain amino acid sequence set forth in SEQ ID NO: 2 is provided comprising altering any X in the amino acid sequence
XVXLXEXGXXXXXXXXXLXLXCXVXDYSITSDYAWNWIXQXXXXXLXWMGYISY
SGSTSXNXXLXXXIXIXRXXXXXXFXLXLXXVXXXDXAXYYCASFDYAHAMDYW
GXGTXVXVXX, and testing an antibody comprising the altered amino acid sequence for binding to an epitope of M-CSF that includes at least 4 contiguous amino acids of SEQ ID NOS: 120 or 121.

161. A method of systematically altering up to 60% of the light chain amino acid sequence set forth in SEQ ID NO: 4 is provided comprising altering any X in the amino acid sequence
XIXLXQXXXXXXVXXXXXVXFXCXAXQSIGTSIHWYXQXXXXXPXLLIKYASEXX
XXIXXXFXGXGXGXXFXLXIXXVXXXDXADYYCQQINSWPTTFGXGTXLXXXXX,
and testing an antibody comprising the altered amino acid sequence for binding to an epitope of M-CSF that includes at least 4 contiguous amino acids of SEQ ID NOS: 120 or 121.